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Correcting for Sampling Bias in the Measurement of Welfare and Poverty

The Case of the Côte d'Ivoire Living Standards Survey

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and
Christiaan Grootaert

Analysts must pay close attention to sampling procedures used to collect survey data. This case study illustrates how observed changes in household welfare and in the incidence of poverty can vanish when corrections are applied to the data for changes in sampling procedures — and how even the direction of the trend may be reversed.

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This paper — a product of the Poverty and Social Policy Division, Africa Technical Department — is part of the output of the research project "Poverty and the Social Dimensions of Structural Adjustment in Côte d'Ivoire, 1985-88: A Policy-Oriented Analysis" (RPO 675-26). Copies of this paper are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Elena Vitanov, room J2-241, extension 38400 (January 1993, 39 pages).

Over the years, household surveys have become a popular, valuable data source for empirical research in microeconomics. In developing countries, household survey data have become more available in the past decade, as a result of several international programs. This has spurred interest in the economics of the household in the context of development economics.

Many analysts give little attention to the sampling design of the surveys they use, taking the data produced by statisticians and survey practitioners "as is." At best, sampling weights are applied to ensure that the results are representative.

Demery and Grootaert illustrate the need to pay close attention to the sampling aspects of a household survey used in applied microeconomic analysis — particularly for comparisons over time. This case study shows that observed changes in household welfare and in the incidence of poverty in Côte d'Ivoire between 1985 and 1988 vanish when corrections are applied to the data for changes in sampling procedures; even the direction of the trend is reversed. Similarly, the cross-sectional patterns of welfare and poverty observed in earlier analyses for 1985-86 prove to be incorrect.

The Côte d'Ivoire Living Standards Survey, conducted between 1985 and 1988, has provided a popular, fruitful data set for policy analysis. But according to Demery and Grootaert, the recorded decline in mean household size during this period is due to sampling bias in the early years of the survey. If this is true, the robustness of the analyses based on these data is questionable.

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Correcting for Sampling Bias in the Measurement of Welfare and Poverty: The Case of the Côte d'Ivoire Living Standards Survey

Lionel Demery
Christiaan Grootaert

This paper is an output of the research project "Poverty and the Social Dimensions of Structural Adjustment in Côte d'Ivoire, 1985-88 — A Policy-Oriented Analysis" (RPO 675-26). The authors would like to thank Gi-Taik Oh and Meera Venkataraman for excellent computer programming and general analytic assistance, and Audrey Cox and Li Ting Fong who processed the paper.

I. Introduction

Over the years, household surveys have proved to be a popular and valuable data source for empirical research in micro-economics. In developing countries, household survey data have become more available in the past decade, partly as a result of several international programs such as the UN National Household Survey Capability Program, the World Fertility Survey, the World Bank's Living Standards Measurement Study and the Social Dimensions of Adjustment Program, the Demographic and Health Surveys and others. This has spurred a growing interest in the economics of the household in the context of development economics, covering a wide array of topics such as poverty, employment, health, education and fertility.

Many analysts — economists and other social scientists — devote only a limited amount of attention to the sampling design of the surveys they use, taking the data produced by statisticians and survey practitioners "as is". At best, sampling weights are applied to ensure representativeness of the results.

The purpose of this paper is to illustrate the necessity of paying close attention to the sampling aspects of a household survey used in applied micro-economic analysis. This is particularly the case when over-time comparisons are undertaken. The case study in this paper will document that changes in household welfare and in the incidence of poverty observed in Côte d'Ivoire over the period 1985-88 vanish when corrections are applied for changes in sampling procedures and that even the direction of the trend is reversed. Likewise, the cross-sectional patterns of welfare and poverty observed in earlier analyses for 1985-86 prove to be incorrect.

The data source for the case study in this paper is the Côte d'Ivoire Living Standards Survey (CILSS) conducted between 1985 and 1988. This survey, especially the early years,

has been a particularly popular and fruitful data set for policy analysis. The studies utilizing these data are too numerous to list here, but a recent selection is Deaton (1987, 1989), Glewwe (1987, 1991), Grootaert (1987, 1990), Van der Gaag and Vijverberg (1989), Kakwani (1990), Kanbur (1990). The CILSS was designed to measure living standards, and by repeating the survey each year, to monitor changes in household welfare over time (see Grootaert, 1986, for a further discussion of the survey and its content). However, a disturbing feature of the CILSS results is the recorded decline in mean household size noted by Daho (1992) and Coulombe and Demery (1992). According to these authors, this is due to sampling bias in the early years of the survey. If this is indeed the case, there are obvious questions surrounding the robustness of the analyses undertaken with these data.

This paper assesses the seriousness of this sampling bias, and makes the necessary adjustments to correct it. This involves re-weighting the original data (discussed in Section III). Given the important role of the household size variable in many recent welfare and poverty studies, comparisons are then made (in Section IV) of estimates of mean per capita expenditure, computed with and without the correcting weights. This is followed in Section V with an assessment of the implications of these finding for poverty estimates. In Section VI the implications for estimates of basic needs indicators are discussed. But first, in the following section (II), the household size results of the CILSS are described briefly.

II. Household Size in the CILSS

Between 1985 and 1988, household size in Côte d'Ivoire declined from 8.31 in 1985 to 6.33 in 1988 (a fall of 24%) according to the "raw" CILSS results (Daho, 1992;

Table 1

Côte d'Ivoire: Mean Household Size by Region
(3-Month Residency)

	Côte d'Ivoire	Abidjan	Other Urban	Rural
1985	8.31	7.11	8.88	8.54
1986	8.01	6.98	8.86	8.16
1987	7.01	6.18	7.31	7.22
1988	6.33	6.02	6.49	6.36
% Decline 1985-88	24	15	27	26

Source: Coulombe and Demery (1992)

Table 2

Côte d'Ivoire: Household Size by Residence Qualification*

Minimum Months present:	9	6	3
1985	7.77	7.98	8.31
1986	7.50	7.70	8.01
1987	6.69	6.84	7.01
1988	6.25	6.16	6.33
% Decline 1985-88	22	23	24

* Minimum number of months present in the household during the past 12 months.

Coulombe and Demery, 1992).1/ Table 1 shows that this decline is recorded for all regions, with Abidjan reporting the lowest decline (15% over the four-year period). These results apply under alternative definitions of the household. In the CILSS, in order to qualify for inclusion in the household, a person must be resident in the household for three months or more during the previous 12 months. This is the definition of the household underlying the estimates reported in Table 1. However, it is perfectly feasible to re-estimate household size under alternative definitions. Such calculations are presented in Table 2, comparing the 3-month residency requirement with 6- and 9-month requirements. It is clear that the changes in residency qualification make little difference to the observed decline. If a stricter definition of membership is applied (for example, requiring that the person has been present at least 6 of the past 12 months), a decline of 23 percent is still observed. In what follows, we take the 6-month residence period as qualification for household membership. 2/ This period is the most logical choice for household membership since with a shorter qualification period a person can be a member of more than one household during the year, and thus be counted more than once in the survey.

The CILSS data collection followed a rotating panel design, i.e., each year after 1985 50 percent of the households were replaced with new ones and the other 50 percent were retained in order to (try to) revisit them. The data structure over the four years contains thus three overlapping panels (see Grootaert and Kanbur, 1992 for further details). This feature

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1/ Proper use of the CILSS data requires the application of three sets of weights. The first set is designed to correct for an over-representation of better-off households in the Abidjan sample for 1985-86. The second set is designed to correct for differences in the distribution of primary sampling units across regions in the 1987-88 sampling frame as compared with the population distribution derived from the 1988 Population Census. Unless stated otherwise, all data presented in this paper have been subjected to the application of those two sets of weights. A third set of weights designed to correct for household size sampling bias is the subject of this paper.

2/ Some members, such as babies newly born to the household and the household head are considered members even when they do not fulfill the 6-month requirement. Others, such as servants and boarders, are always excluded because they are considered as members of separate households in the survey.

of the data has an important bearing on the interpretation of the observed decline in household size. Table 3 explains how the data in the four years of the survey may be divided into 14 data sets, depending on whether or not the household forms one of the three panels. Set 1 data refer to households interviewed only once in 1985 and not revisited thereafter. Households in set 2 are those which were interviewed in 1985 with the intention of including them in the first panel, but which were not found again in 1986 (mainly because they had changed residence by the second year). The data in set 5 are then the replacements for these households in 1986. The panel households themselves are in sets 3 and 4, for the interviews in 1985 and 1986 respectively. The panel data sets for the other years are defined in a similar way.

Table 3

CILSS: Panel Data Sets, 1985-1988

Set 1	Non-panel households, 1985
Set 2	Unmatched households from first panel, 1985
Set 3	First panel households, 1985
Set 4	First panel households, 1986
Set 5	Unmatched households from first panel, 1986
Set 6	Unmatched households from second panel, 1986
Set 7	Second panel households, 1986
Set 8	Second panel households, 1987
Set 9	Unmatched households from second panel, 1987
Set 10	Unmatched households from third panel, 1987
Set 11	Third panel households, 1987
Set 12	Third panel households, 1988
Set 13	Unmatched households from third panel, 1988
Set 14	Non-panel households, 1988

Table 4 reports the sample size and mean household size of each panel set.3/ The key observation is that the decline in household size is almost entirely absent within the panels, with the exception of the second panel covering the years 1986-87 (a decline from 7.85 in 1986 to 7.36 in 1987). The order of magnitude of the decline in mean household size recorded through non-panel comparisons across the years cannot be considered as simply reflecting a real trend in household formation and composition in Côte d'Ivoire. For example, compare mean household size in set 4 (1986) which is 7.96 and set 11 (1987), which is only 6.54. A decline of almost 20 percent in just one year is extremely unlikely.

There are three alternative explanations of these observed declines in mean household size:

- it is due to non-sampling errors (i.e., measurement errors), arising from either over-zealous enumeration in the early years of the survey, or less rigorous enumeration as the survey was repeated each year (for example, due to a deterioration in field supervision);

- it arises from biases in sampling, with over-sampling of either large households in the early years, or smaller households in the later years of the survey;

- it reflects an underlying reality of demographic change.

There is little evidence that non-sampling errors are responsible. Various tests applied to the data, suggest that data quality was maintained over the four years of the

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3/ The difference in the sample sizes of sets 2 and 5 (the unmatched households in the first panel, and the 1986 replacement households) needs to be explained. Whilst 79 households failed to qualify for the 1st panel, 86 households were selected as replacements. This is because the sample in 1985 was only 1593 (that is 7 short of a full sample of 1600 households). Thus, 7 households were selected in addition to the 79 replacement households to restore the sample to 1600 households in 1986.

CILSS. Field supervision generally improved over time (Daho, 1992). Moreover, the fact that the decline in household size arises from recorded declines in nuclear family members, does not support the hypothesis that there was an increasing tendency to under-enumerate when completing the household roster. If enumerators were tempted to under-record when completing the household roster they would most probably have left out more distant relatives and marginal household members (Coulombe and Demery, 1992).

The case for sampling bias as the main responsible factor is based on the observation that although household size declined throughout the period for all regions, a discontinuity is observed in the data. In particular, the drop in recorded household size is most severe between 1986-87, especially when non-panel households are considered. This discontinuity coincides with a change in the sampling procedures used in the CILSS. For the years 1985 and 1986, the sample was drawn from a sampling frame derived from demographic projections based on the 1975 Population Census. In 1987, the sampling frame was changed, and was derived from an electoral census. In 1988, the frame was again updated and derived from preliminary results of the 1988 Population Census.

Moreover, the procedures used to draw the sample were also not constant over time. In mid-1984, a pre-survey was carried out to list 64 households in each of 100 primary sampling units (PSU) which had been selected with probabilities proportional to their population, stratified by region. For 1985, a sample of 16 households was randomly drawn from the 64-household listing in each PSU, so that a sample of about 1600 households was achieved for 100 clusters. In 1986 half the sample (from 50 clusters) was surveyed a second time to form a panel of households, and 800 new households were selected from the other 50 clusters. In 1987, changes were introduced to this selection procedure. A complete listing was made of *all* households in each cluster, and a random selection of 16 households was taken from this complete list. This change in procedure (and the revised sampling frame mentioned earlier) only affected half the sample of 1987, since the other half of the sample (forming the 1986-87 panel) had been selected in 1986 under the previous sampling regime. Thus in 1987, households in panel set 8 were selected on the original sampling frame and

Table 4

Côte d'Ivoire: Sample and Household Sizes by Panel Grouping

A. Sample Size by Panel Data Set*

	Non-panel	No match	1st Panel	No match	2nd Panel	No match	3rd Panel	Non-panel
1985	1) 795	2) 79	3) 714					
1986		5) 86	4) 714	6) 107	7) 693			
1987				9) 107	8) 693	10) 99	11) 701	
1988						13) 99	12) 701	14) 800

B. Mean Household Size by Panel Data Set*

	Non-panel	No match	1st Panel	No match	2nd Panel	No match	3rd Panel	Non-panel
1985	1) 8.25	2) 5.25	3) 8.03					
1986		5) 5.14	4) 7.96	6) 7.20	7) 7.85			
1987				9) 6.28	8) 7.36	10) 5.92	11) 6.54	
1988						13) 5.31	12) 6.53	14) 5.95

C. Weighted Household Size by Panel Data Set*

	Non-panel	No match	1st Panel	No match	2nd Panel	No match	3rd Panel	Non-panel
1985	1) 6.77	2) 4.46	3) 6.52					
1986		5) 4.40	4) 6.49	6) 5.88	7) 6.36			
1987				9) 4.92	8) 6.10	10) 5.93	11) 6.53	
1988						13) 5.31	12) 6.53	14) 5.95

* See Table 3 for details of panel data set numbering.

procedure, whilst those in panel set 11 were sampled under a new frame and revised listing procedure (see Daho, 1992, for a further discussion).

The household size estimates reflect closely this change in the sampling frame and listing procedures. The initial sampling frame and listing procedures applied to 1985, 1986 and half the 1987 sample. Pooling these observations (that is, panel data sets 1-8), mean household size is 7.77 for the country as a whole. If the other half of the 1987 sample is pooled with the 1988 sample (i.e., taking all observations derived under the revised sampling frame and listing procedures, which entails combining panel sets 9-14), the mean household size is 6.26. As a rough indicator, this suggests that 83 percent of the 1985-88 decline (from 7.98 to 6.16) is 'explained' by the change in the sampling procedures. It seems that the procedures used in listing the 64 households in 1985 and 1986 were biased towards a selection of larger households in the PSU. The exact reason for this is not clear, but the fact that larger dwellings are more noticeable and prone to selection than smaller dwellings must have led to a bias in the listing. Indeed, mean *dwelling* size recorded in the CILSS was significantly higher in 1985 and 1986 than in 1987 and 1988.

Coulombe and Demery (1992) have applied tests for statistical significance of differences in mean household size; which support that the revision in sampling procedures was responsible for most of the decline. One of the most telling comparisons is between mean household size in the two halves of the 1987 sample. This was 7.36 for set 8 (see Table 4), which formed the second panel and which is based on the original sampling procedures, and only 6.54 for set 11, which was enumerated under the revised sampling procedures. This difference is statistically significant at the 99 percent level. (The difference between data sets 8 and 11 was also statistically significant for each region, except Abidjan).

Whilst the evidence strongly points to the existence of sampling bias in the early years of the survey as the explanation of much of the observed decline in household size, it

does not explain all of it. Some household size declines were observed even when no change in sampling procedures occurred. The explanation for the remaining portion of the decline can probably be found in part in measurement error and in part in a real phenomenon. The economic hardship over the period, particularly in 1987 and 1988 may have led to a break-up in traditional extended households and their implied mutual support systems. The data do confirm an increase in one- and two-person households over time. There may also have been increased migration as a response. If new migrants moved into dwellings not included in the survey's sampling frame, this may have contributed to observing a decline in household size among those households in the survey. Clearly, these issues require further research.

III. Correcting the Sampling Bias

In many respects, the finding that sampling bias is largely responsible for the astonishing decline in household size in the CILSS is good news. If it were due to non-sampling errors, it would be extremely difficult to correct. Moreover, household size estimates for each household would be suspect, and household-level analysis would have been seriously flawed. As it is, the analysis suggests that non-sampling errors are not the major problem, so that the household size for each household can be considered fairly accurate. The inaccuracy lies in the sampling across the households -- too many large households were enumerated in the early years, creating a bias in the estimate of mean household size. To correct for this an appropriate re-weighting of the sample is called for.

The main requirements for such re-weighting scheme are:

- it should correct for differences observed within each region (i.e., stratum) in estimated household size under the original and revised sampling procedures;

it should correct only those differences due to sampling factors — in other words, the part of the observed decline which reflects an underlying reality should be retained in the data.

The following procedures for weighting the sample to correct for the household size bias fulfill these requirements. First, it is assumed that the distribution of households obtained under the revised sampling frame and listing procedures (i.e. for 1987-88) is the true distribution, and that the distribution obtained under the original sampling procedures needs to be corrected. Second, two distributions are generated with the four years of data: Pool I data consist of all observations obtained under the original procedures -- that is, data sets 1 - 8 (see Tables 3 and 4). Pool II data comprise the remaining sets (that is 9 - 14). These distributions were generated for each of five strata in the survey (Abidjan, Other Urban, East Forest, West Forest and Savannah) and are reproduced in Annex I. Third, household-size weights are computed as the ratio of the frequencies in Pool I and Pool II for each size class (households are distributed across 18 size classes). These ratios are also reported in Annex I. To illustrate how these weights are then applied to re-weight the observations in data sets 1 - 8, Tables 5 and 6 report the pre- and post-weighted distributions of households in East Forest in 1985.

For the country as a whole, the household-size (H-S) weights reduce mean household size to 6.51, 6.25 and 6.20 in 1985, 1986 and 1987 respectively (Table 7). For 1985 and 1986 (in which the whole sample was subjected to H-S weights), this reduction amounts to over 18 percent of the mean computed without the H-S weights. Since only a half of the sample in 1987 is subjected to H-S weights, the reduction in the mean is only 9 percent.

This effect of the H-S weights, however, is not evenly spread throughout the country (Table 7). The upward bias in mean household size appears to have been more of a problem in East and West Forest, and in urban areas other than Abidjan. The order of magnitude of the correction implied by the weights is certainly not trivial -- mean household size is reduced by as much as a quarter in West Forest and Other Urban areas. Savannah and

Table 5

Calculation of Household-Size Weights, East Forest

Size Class	Frequency Distribution (%) Pool I* (1)	Pool II* (2)	Household-size Weights (2)/(1)
1	3.8589	6.6106	1.71308
2	4.8512	7.8495	1.61806
3	7.3870	9.6616	1.30792
4	9.4818	10.0407	1.05894
5	8.4895	11.8251	1.39290
6	9.9228	11.9360	1.20289
7	8.4895	7.9512	0.93659
8	8.2690	8.8757	1.07337
9	7.0562	6.2777	0.88967
10	5.2922	4.7245	0.89273
11	4.7409	3.7629	0.79372
12	3.6384	2.2744	0.62512
13	4.4101	2.4871	0.56394
14	2.9768	0.6379	0.21430
15	1.7641	1.4238	0.80713
16	2.6461	1.1372	0.42977
17	2.0948	0.6379	0.30453
≥ 18	4.6307	1.8861	0.40731

* Pool I contains households in data sets 1 - 8.
Pool II contains all other observations (that is, data sets 9 - 14).
See Table 3 for definition of data sets.

Table 6

Côte d'Ivoire: Application of Household Size Weights for East Forest, 1985

Size Class	Unweighted Frequency (%)	Ratio of Pool I & Pool II Frequencies	Weighted Frequency (%)
1	3.3	1.71308	5.6
2	4.7	1.61806	7.4
3	7.7	1.30792	9.9
4	9.3	1.05894	9.8
5	10.4	1.39290	14.5
6	10.4	1.20289	12.5
7	7.4	0.93659	7.0
8	9.9	1.07337	10.5
9	6.6	0.88967	5.8
10	4.9	0.89273	4.4
11	3.6	0.79372	2.8
12	2.7	0.62512	1.8
13	3.0	0.56394	1.8
14	4.4	0.21430	1.1
15	1.1	0.80713	0.9
16	3.3	0.42977	1.4
17	1.9	0.30453	0.6
≥ 18	5.2	0.40731	2.1
Mean household size:	8.44		6.60
Standard Deviation:	6.99		5.15

Table 7

Côte d'Ivoire: Mean Household Size with and without Household-Size Weights, by Region 1985-88

	Abidjan			Other Urban			East Forest			West Forest			Savannah			Côte d'Ivoire		
	A.	B.	% Diff.	A.	B.	% Diff.	A.	B.	% Diff.	A.	B.	% Diff.	A.	B.	% Diff.	A.	B.	% Diff.
1985	6.87	6.18	-10.0	8.52	6.41	-24.8	8.44	6.60	-21.8	8.00	6.03	-24.6	8.04	7.24	-10.0	7.98	6.51	-18.4
1986	6.57	5.90	-10.2	8.53	6.54	-23.3	8.22	6.56	-20.2	7.63	5.76	-24.5	7.39	6.32	-14.5	7.70	6.25	-18.8
1987	6.06	5.79	- 4.5	7.20	6.21	-13.8	7.49	6.74	-10.0	6.59	5.84	-11.2	6.70	6.21	-7.3	6.84	6.20	-9.4
1988	5.88	5.88	-	6.33	6.33	-	6.46	6.46	-	5.62	5.62	-	6.35	6.35	-	6.16	6.16	-

A. Mean household size computed without household-size weights.
B. Mean household size computed with household size weights.

Table 8

Côte d'Ivoire: Mean Household Size with and without Household-Size Weights by Socio-Economic Group, 1985-88

	1985			1986			1987			1988
	A.	B.	% Diff.	A.	B.	% Diff.	A.	B.	% Diff.	A.*
Export Crop Farmers	9.28	6.92	-25.4	9.16	6.97	-23.9	7.75	7.02	-9.4	6.75
Food Crop Farmers	8.37	7.06	-15.7	7.70	6.48	-15.8	7.14	6.54	-8.4	6.38
Public Sector Employees	7.42	6.35	-14.4	7.68	6.52	-15.1	7.03	6.43	-8.5	7.33
Formal Private Sector Employees	7.14	6.33	-11.3	6.40	5.75	-10.2	6.09	5.87	-3.6	5.60
Informal Private Sector Employees	5.00	4.27	-14.6	4.54	3.62	-20.3	4.60	4.33	-5.8	4.34
Self-Employed	7.41	5.74	-22.5	7.51	5.78	-23.0	5.96	5.09	-14.6	5.15
Inactive	8.09	5.78	-28.6	7.58	6.02	-20.6	6.71	5.86	-12.7	5.82
Unemployed	6.99	6.40	-8.4	4.59	4.75	- 3.5	5.74	5.38	-6.3	5.71
Côte d'Ivoire	7.99	6.51	-18.5	7.72	6.27	-18.8	6.85	6.20	-9.5	6.17

A. Mean household size computed without household-size weights.
B. Mean household size computed with household-size weights.
* Since 1988 data were obtained entirely under the revised sampling frame and sampling procedures, no household-size weights are applied.

Abidjan are least affected by the application of H-S weights, although even here, mean household size is reduced by over 10 percent.

Similarly, these adjustments in the data have varying effects on different groupings of households. Table 8 reports mean household size with and without the application of H-S weights for each of eight socio-economic groups.4/ The mean size of export-crop farming households is reduced by about a quarter, with similar orders of magnitude applying to the self employed, informal-sector employees (at least in 1986) and the inactive. There are two reasons why the over-representation of larger households in the sample affects some socio-economic groups more than others. First, the main geographical location is not the same for each group. For example, export-crop farmers are located mainly in East and West Forest, where over-representation of larger households was greater, rather than the Savannah, where the sampling bias was not as significant. Similarly, the relatively small effect that H-S weighting has on formal-sector workers (both private and public) arises from their location predominantly in Abidjan. The second reason is that household size is related systematically to socio-economic category. For example, very large households — where the re-weighting has the most pronounced effect — are more prevalent among export crop farming and urban self-employed households.

IV. Implications for Estimates of Mean Household Expenditures

The fact that the application of H-S weights to the CILSS data set reduces mean household size significantly, and that the effects are concentrated among certain areas and socio-economic groups, suggests that this procedure may have an important bearing on other findings of the survey. Our interest here is to assess the effects of correcting for household-size-related sampling bias on three types of variables: total household expenditure per capita; estimates of poverty incidence based on per capita expenditures as an indicator of welfare; and basic needs indicators. Our intention is to answer two important questions:

4/ The categorization of households into each of these groups is based on the main source of income for the household and the employment status of the household head (it follows Grootaert, 1992).

first, does the sampling bias for the early years of the survey (and its correction through the application of the H-S weights) significantly affect the *level* of variable means? Second, are the *patterns* of expenditure per capita, poverty and basic needs fulfillment (both regionally and across socio-economic groups) changed as a result of the weighting?

There are both theoretical and practical advantages in using total household expenditure as a measure of household welfare, and this is reflected in the popularity of this variable (expressed in per capita terms) in many of the poverty studies conducted with CILSS data (Kakwani, 1990, Kanbur, 1990, Glewwe, 1991). It seems sensible therefore to begin with an assessment of how the H-S weights affect mean per capita total household expenditure.

Table 9 reports two estimates of the variable for each year. Column A gives mean expenditures without any adjustment for household size, and column B reports mean values after the application of H-S weights. For Côte d'Ivoire as a whole, the effect is to *increase* mean expenditure by 7.5 percent in 1985, 9.7 percent in 1986 and 3.18 percent in 1987. The lower figure for 1987 is to be expected, given that only a half of the sample of that year was subjected to the H-S weights. Clearly, the per capita expenditures of larger households are *lower* than average, so that reducing their weight has the effect of increasing the overall mean. The order of magnitude of the error introduced by the sample bias is not insignificant: in 1986, for example, the original estimates of mean per capita expenditure for Côte d'Ivoire as a whole were about 10 percent too low.

Of equal significance is the uneven effect that the H-S weights have across the regions. Predictably, given the fact that mean household size corrections were least in Abidjan and Savannah, per capita expenditure in these regions are also the least affected by the H-S weights. And again, the most serious bias appears in Other Urban areas and West Forest, at least in 1985 and 1986. Whilst the correction does not change the rank ordering of the regions, it does change some differentials noticeably. For example, originally mean per capita expenditure in Abidjan was estimated to be 32.7 percent higher than other urban

Table 9

Côte d'Ivoire: Mean Per Capita Total Household Expenditures with and without Household-Size Weights by Region, 1985-1988

	1985			1986			1987			1988
	A.	B.	% Diff.	A.	B.	% Diff.	A.	B.	% Diff.	A.*
Abidjan	357,410	376,108	5.23	291,316	312,859	7.40	361,544	372,361	2.99	288,708
Other Cities	240,638	271,864	12.98	235,810	270,540	14.73	237,570	250,010	5.24	178,165
East Forest	156,342	164,472	5.20	162,980	172,341	5.74	165,271	167,974	1.64	152,501
West Forest	225,277	239,134	6.15	184,427	204,457	10.86	170,298	169,776	-0.31	143,947
Savannah	148,156	152,573	2.98	147,466	154,676	4.89	133,947	136,061	1.58	120,684
Côte d'Ivoire	221,313	237,853	7.47	204,183	223,905	9.66	210,286	216,965	3.18	173,072

A. Mean per capita expenditure computed without household-size weights.
B. Mean per capita expenditure computed with household-size weights.
* Since 1988 data were obtained entirely under the revised sampling frame and sampling procedures, no household-size weights are applied.

areas in 1985 (19.1% in 1986). After correcting for the over-representation of larger households in the sample in 1985, the differential is reduced to 27.7 percent (13.5% in 1986).

Somewhat puzzling is the influence of the H-S weights on West Forest in 1987, where mean per capita expenditure is marginally reduced. This occurred despite a decrease in mean household size of 11 percent (Table 7). It seems that for 1987 at least, the larger households in West Forest enjoyed above-average expenditure levels compared with smaller households, so that reducing their weight reduces the overall mean, albeit marginally. In all other cases, mean expenditures are adjusted upward.

How do these corrections influence the socio-economic group data? The evidence of Table 10 is that the sampling bias also has uneven effects on socio-economic groups. Not surprisingly, mean expenditures of socio-economic groups based largely in Abidjan (mainly formal private sector employees) are affected little by the H-S weights. Similarly, those based predominantly in Savannah (food-crop farmers) are also affected less than other groups. On the other hand, mean expenditure of export-crop farmers (especially those located in West Forest) increases noticeably.

There are some minor changes in the rank ordering of the groups (for example, informal sector employees and the self-employed switch rank order in 1985), but the main effect of the H-S weights is to change differentials in the welfare measure. For example, per capita expenditure among export crop farmers is recorded as 4.9 percent higher than food-crop farmers in 1985 based on the original biased data. This differential increases to 11.6 percent as a result of the weighting. Similarly, government employees appeared to enjoy expenditure levels which were 11.8 percent higher than their counterparts in the formal private sector in 1986, whilst in reality, i.e. when the sampling bias is corrected, the difference was 18.4 percent. Such adjustments in measured differentials between the groups are obviously important, and underline the significance of correcting for the over-estimation of household size in the early years of the CILSS. Indeed, the differences are large enough to be of more than mere academic interest, and to have a potential effect on policy

Table 10

Côte d'Ivoire: Mean Per Capita Total Household Expenditures with and without Household-Size Weights by Socio-Economic Group, 1985-1988

	1985			1986			1987			1988
	A.	B.	% Diff.	A.	B.	% Diff.	A.	B.	% Diff.	A.*
Export Crop Farmers	175,840	194,418	10.57	166,601	182,715	9.67	158,791	158,434	-0.22	140,906
Food Crop Farmers	167,235	171,802	2.73	155,292	165,034	6.27	151,795	153,771	1.31	132,809
Public Sector Employees	394,987	431,171	9.16	356,881	401,988	12.64	349,514	364,820	4.38	254,402
Formal Private Sector Employees	346,100	364,835	5.41	314,902	328,060	4.18	367,494	385,322	4.85	278,708
Informal Private Sector Employees	223,698	230,593	3.08	169,723	191,132	12.61	189,422	186,294	-1.65	144,153
Self-Employed	217,439	234,910	8.03	200,874	217,634	8.34	206,577	212,771	3.00	174,333
Inactive	233,905	253,049	8.18	214,911	233,127	8.48	201,489	201,330	-0.08	191,040
Unemployed	320,954	306,624	4.46	247,561	228,037	7.89	193,179	203,729	5.46	190,503
Côte d'Ivoire	221,313	237,853	7.47	204,183	223,905	9.66	210,286	216,965	3.18	173,072

A. Mean per capita expenditure computed without household-size weights.
B. Mean per capita expenditure computed with household-size weights.
* Since 1988 data were obtained entirely under the revised sampling frame and sampling procedures, no household-size weights are applied.

interventions. While the corrections may not imply changes of target groups as such (at least not at a relatively aggregated level), they do affect significantly the quantification of resources needed for interventions. Even at the qualitative level, the changes in inter-regional and inter-group differentials following the corrections may make the difference between triggering interventions or not.

V. Poverty Estimates

The fact that mean per capita expenditures are generally underestimated as a result of the sampling bias, suggests that poverty is likely to have been *overestimated* in the early years of the survey. In making an assessment of how the H-S weights affect measures of poverty, we compare poverty measures computed with and without the weights.

Estimates of the P_α class of poverty indices5/ have been computed for all four years of the CILSS by Grootaert (1992). These estimates are based on the aggregates reported in Demery and Grootaert (1992), a regional price index estimated by Grootaert and Kanbur (1992) and on the application of the H-S weights. The poverty line (128,600 CFAF) is selected to classify 30 percent of the population as poor in 1985. An alternative line (75,000

5/ The P_α index is given by

$$P_\alpha = \frac{1}{n} \sum_{i=1}^{q} \left[\frac{Y_p - Y_i}{Y_p} \right]^\alpha$$

where n is the population size, q is the number of people below the poverty line (Y_p) and Y_i ($i = 1,\ldots,q$) are the incomes of the poor. α is a policy parameter chosen by users to reflect their aversion to poverty. For $\alpha = 0$, the index is simply the head-count index ($H = q/n$). With $\alpha = 1$, the index becomes HI, where I is the income gap ratio,

$$I = \frac{1}{q} \sum_{i=1}^{q} \left[\frac{Y_p - Y_i}{Y_p} \right].$$

CFAF) identifies 10 percent of the population as poor -- termed the very poor. Grootaert (1992) concludes that the incidence of overall poverty was unchanged between 1985 and 1986, but the incidence of extreme poverty fell. After 1986, the incidence of both poverty and extreme poverty rose. This was especially true of 1987-88, when the poverty head-count ratio increased from 34.8 percent to 45.9 percent (and from 9.1% to 14.1% for extreme poverty).

What would these results have been without the application of H-S weights? Tables 11 and 12 give estimates of the head-count ratio (P_0) as reported by Grootaert (1992) (column B) and without the application of the H-S weights (column A). As expected, the weights *reduce* the incidence of poverty noticeably. This is especially true for 1986, with estimates of the head-count ratio for the country as a whole being adjusted downward by 13.6 percent for the poor and 12.3 percent for the very poor.

The original — biased — results showed a slow but steady increase in poverty between 1985 and 1987. The corrected results not only indicate that the level of poverty was overestimated, but that the trend was different too. With the corrected data, poverty is shown to remain steady between 1985 and 1986, and then to rise rapidly in 1987. Clearly, any attempt to link these changes causally to macro-economic events or policy would come up with very different answers depending upon whether the original or corrected results are used (see Grootaert 1992 for such analysis).

Reflecting the pattern of changes observed in per capita total household expenditure following the application of the weights (Table 9), head-count estimates of poverty and extreme poverty are also revised in different ways across the regions (Tables 11 and 12). The main differences occur in 1986, with downward adjustments in the poverty estimates for all regions. An exception is that the estimates of extreme poverty in Abidjan and West Forest are revised upward. This suggests that in West Forest and Abidjan very poor

Table 11

Côte d'Ivoire: P_0 Estimates of Poverty with and without Household-Size Weights by Region, 1985-88
(Poverty Line = 128,600 CFAF)

	1985			1986			1987			1988
	A.	B.	% Diff.	A.	B.	% Diff.	A.	B.	% Diff.	A.*
Abidjan	0.041	0.034	-17.07	0.206	0.166	-19.42	0.078	0.074	-5.13	0.139
Other Cities	0.272	0.236	-13.24	0.277	0.223	-19.49	0.225	0.244	8.44	0.409
East Forest	0.501	0.479	- 4.39	0.425	0.395	-7.06	0.445	0.435	-2.25	0.494
West Forest	0.209	0.178	-14.83	0.283	0.200	-29.33	0.375	0.376	0.27	0.553
Savannah	0.523	0.502	-4.02	0.522	0.481	-7.85	0.589	0.578	-1.87	0.652
Côte d'Ivoire	0.324	0.300	-7.10	0.346	0.299	-13.58	0.354	0.348	-1.69	0.459

A. P_0 computed without household-size weights.
B. P_0 computed with household-size weights.
* Since 1988 data were obtained entirely under the revised sampling frame and sampling procedures, no household-size weights are applied.

Table 12

Côte d'Ivoire: P_0 Estimates of Extreme Poverty with and without Household-Size Weights by Region, 1985-88
(Poverty Line = 75,000 CFAF)

	1985			1986			1987			1988
	A.	B.	% Diff.	A.	B.	% Diff.	A.	B.	% Diff.	A.*
Abidjan	0.006	0.007	16.67	0.012	0.014	16.67	0.011	0.017	54.55	0.000
Other Cities	0.092	0.080	-13.04	0.071	0.055	-22.54	0.052	0.047	-9.61	0.073
East Forest	0.145	0.132	-8.97	0.116	0.095	-18.10	0.088	0.086	-2.27	0.139
West Forest	0.023	0.016	-30.43	0.016	0.019	18.75	0.091	0.093	2.20	0.161
Savannah	0.227	0.226	-0.44	0.123	0.121	-1.63	0.195	0.194	-0.13	0.305
Côte d'Ivoire	0.105	0.100	-5.71	0.073	0.064	-12.33	0.092	0.091	-1.09	0.141

A. P_0 computed without household-size weights.
B. P_0 computed with household-size weights.
* Since 1988 data were obtained entirely under the revised sampling frame and sampling procedures, no household-size weights are applied.

households are smaller than average. (The effect of the H-S weights is to increase the representation of small households, and to decrease that of larger households.) Although large households generally have lower levels of per capita expenditure, clearly this is not always the case for the very poor. Why, however, this should be true for 1986 and not for 1985 (when the estimate of extreme poverty is seen to be reduced by the H-S weights), is a matter for conjecture at this stage.

It is noteworthy that the measured incidence of poverty in Abidjan is reduced significantly as a result of the H-S weights (by 17.1% in 1985 and 19.4 % in 1986), even though mean expenditure in Abidjan was increased only slightly by the application of the weights. This suggests that expenditures of many of the poor are only marginally below the poverty line.

Tables 13 and 14 report estimates of the incidence of poverty and extreme poverty (respectively) by socio-economic group. The reduction in the head-count estimates resulting from H-S weights is not evenly spread across the groups. Downward adjustments for both years are greatest for export-crop farmers, public sector employees and informal-sector employees, and least for food-crop farmers. For other groups, the effect differs by year. For example, P_0 estimates for private formal sector employees are not adjusted greatly in 1985, but are revised downward by 26.7 percent in 1986. There are no changes in the rank ordering for 1985 as a result of the H-S weights, but there are some changes induced in 1986. Whereas the incidence of poverty appeared to be greatest among informal-sector employees in 1986 (based on data not subjected to the H-S weights), the group takes second place behind food-crop farmers as a result of the weighting.

The main implications for the estimates of extreme poverty (Table 14) are that the H-S weights reduce extreme poverty significantly among export-crop farmers and informal-sector employees in 1985, and among export-crop farmers and the self-employed in 1986. The incidence of extreme poverty among food-crop farmers is not changed greatly.

Do these findings critically depend on the choice of poverty index and poverty line selected? Dominance tests were applied to the data, comparing the distribution before and

Table 13

Côte d'Ivoire: P_0 Estimates of Poverty with and without Household-Size Weights by Socio-Economic Group, 1985-88
(Poverty Line = 128,600 CFAF)

	1985			1986			1987			1988
	A.	B.	% Diff.	A.	B.	% Diff.	A.	B.	% Diff.	A.*
Export Crop Farmers	0.428	0.366	-14.48	0.414	0.354	-14.49	0.480	0.477	-0.63	0.548
Food Crop Farmers	0.445	0.434	-2.47	0.450	0.411	-8.67	0.478	0.473	-1.05	0.590
Public Sector Employees	0.062	0.049	-20.97	0.071	0.056	-21.13	0.075	0.072	-4.00	0.213
Formal Private Sector Employees	0.069	0.071	2.90	0.131	0.096	-26.72	0.062	0.061	-1.61	0.151
Informal Private Sector Employees	0.312	0.262	-16.02	0.507	0.401	-20.91	0.363	0.364	0.28	0.542
Self-Employed	0.282	0.262	-7.09	0.332	0.287	-13.55	0.330	0.333	0.91	0.462
Inactive	0.200	0.183	-8.50	0.273	0.211	-22.71	0.321	0.327	1.87	0.319
Unemployed	0.024	0.041	70.83	0.348	0.346	-0.57	0.393	0.312	-20.61	0.383
Côte d'Ivoire	0.324	0.300	-7.10	0.346	0.299	-13.58	0.354	0.348	-1.69	0.459

A. P_0 computed without household-size weights.
B. P_0 computed with household-size weights.
* Since 1988 data were obtained entirely under the revised sampling frame and sampling procedures, no household-size weights are applied.

Table 14

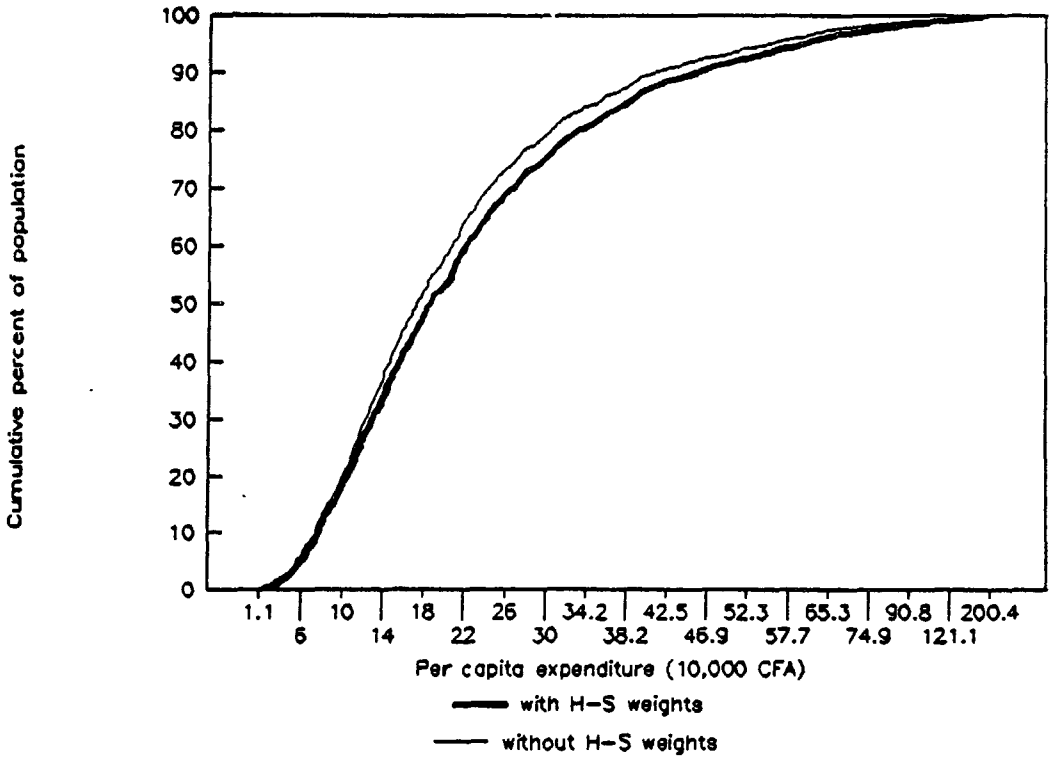
Côte d'Ivoire: P_0 Estimates of Extreme Poverty with and without Household-Size Weights by Socio-Economic Group, 1985-88
(Poverty Line = 75,000 CFAF)

	1985			1986			1987			1988
	A.	B.	% Diff.	A.	B.	% Diff.	A.	B.	% Diff.	A.*
Export Crop Farmers	0.116	0.086	-25.86	0.100	0.081	-19.00	0.144	0.148	2.78	0.210
Food Crop Farmers	0.147	0.150	2.04	0.106	0.101	-4.72	0.114	0.111	-2.63	0.197
Public Sector Employees	0.002	0.003	50.00	0.000	0.000	-0.011	0.009	-	18.18	0.039
Formal Private Sector Employees	0.005	0.008	60.00	0.000	0.000	-	0.013	0.013	0.00	0.007
Informal Private Sector Employees	0.113	0.099	-12.39	0.000	0.000	-	0.067	0.067	0.00	0.220
Self-Employed	0.122	0.115	-5.74	0.067	0.052	-22.39	0.067	0.070	4.48	0.107
Inactive	0.071	0.063	-11.27	0.031	0.028	- 9.68	0.159	0.176	10.69	0.072
Unemployed	0.000	0.000	-	0.087	0.137	57.47	0.000	0.000	-	0.088
Côte d'Ivoire	0.105	0.100	-5.71	0.073	0.064	-12.33	0.092	0.091	-1.09	0.141

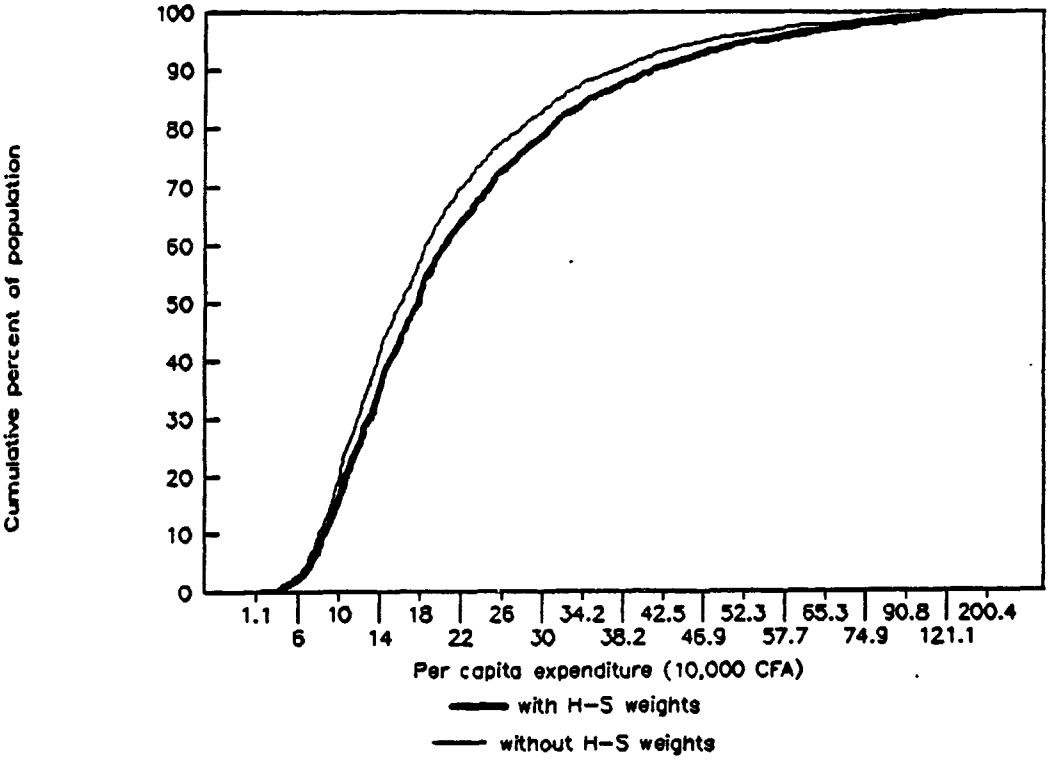
A. P_0 computed without household-size weights.
B. P_0 computed with household-size weights.

Figure 1: Distribution of Household Per Capita Expenditures with and without Household Size Weights, 1985 and 1986

Côte d'Ivoire 1985



Côte d'Ivoire 1986



after the application of the H-S weights (see Atkinson, 1987 and Ravallion, 1992 for further details of these tests). Figure 1 compares the cumulative distribution of per capita household expenditures with and without H-S weights for 1985 and 1986. This shows that for both years, the unweighted distribution lies entirely to the left and above the original one. This first order dominance indicates that whichever poverty index or poverty line is selected, measured poverty will be greater for the unweighted distribution. This adds further support to our conclusion that the original uncorrected data yield overestimates of poverty in Côte d'Ivoire for 1985 and 1986.

Lastly, as a methodological point, the revisions in poverty estimates following the application of the corrective H-S weights is the net results of two effects, operating respectively on the mean and the distribution. Because household size is related to the level of expenditures, the re-weighting changes the mean level of expenditures (see previous section). However, since large households are located along the distribution with different frequency, the re-weighting will also alter the distribution (even if there were no change in the mean). It is possible to compute the contribution of each effect on the change in $P\alpha$. Such computations showed that the mean effect dominates and is negative (i.e., it reduces $P\alpha$). The signs and magnitudes of the distribution effects vary across regions. As we have seen, the net effect in most cases was to reduce the estimate of poverty incidence.

In summary, more than was the case for the estimate of household expenditures, the measured incidence of poverty is significantly affected by sampling bias in the CILSS. For several socio-economic groups and regions, uncorrected figures over-estimate poverty and extreme poverty by 20-30 percent - biases which could well be the difference between whether or not such groups become targets for government programs to alleviate poverty. Moreover, the removal of sampling bias leads to a reversal of the originally observed trend in poverty change between 1985 and 1986 — thus potentially leading to a different assessment of policies conducted over the period.

The changes we have observed in group differentials and in rank ordering have significance for past studies reporting poverty patterns in Côte d'Ivoire based on CILSS data. For example, Kanbur (1990) decomposes the P_α index for 1985 by socio-economic group in making his assessment of the effects of structural adjustment.6/ The evidence we have presented on group poverty estimates suggests that Kanbur's findings may not be robust to the corrections for sampling bias we have discussed. For example, Kanbur places export crop farmers second in a rank ordering of extreme poverty (behind food crop farmers). However, the H-S weights were found to significantly affect the poverty estimate for this group, reducing the head-count from 11.6 percent to 8.6 percent (Table 14). It is clear that Kanbur's results based on data subject to an uncorrected sampling bias must be interpreted with care. Similarly, Kakwani (1990) analyzes the statistical significance of differences between group poverty levels. His groupings are based on region and on various characteristics of the household head. The adjustments made by the H-S weights to group poverty differentials suggest that Kakwani's results may well have been different had he accounted for the underlying sampling bias. Similar comments would apply to other studies which rely on money-metric measures of welfare and poverty, such as Glewwe (1987).

VI. **Basic Needs Indicators**

Taking per capita expenditure as measure of economic welfare, the CILSS data for 1985 and 1986 have been found to under-estimate living standards and to over-estimate poverty. To what extent does this result also apply to other welfare indicators? In this section an assessment is made of how selected basic needs indicators are changed through the application of the H-S weights.

6/ Our estimates of household expenditure per capita differ from those reported in Kanbur (1990). This is due to variations in data cleaning and editing procedures.

Table 15 reports four basic needs indicators derived from the CILSS, disaggregated by region.7/ The H-S weights make very little difference to the indicators. For the country as a whole, the indicators are marginally reduced by the weights. That there is little adjustment arising from the H-S weights suggests that the basic needs indicators are not closely related to household size. An examination of the data confirms this.8/

An interesting feature of the results is the difference in the direction of change between Abidjan and the other regions. For Abidjan, most indicators are adjusted *upward* by the H-S weights, whereas for the other regions the adjustment tends to be downward. Although most of these adjustments are small, they suggest that larger households in Abidjan have lower basic-needs fulfillment compared with smaller households, so that reducing their weight in the sample increases the indicator. The opposite seems to apply to the other regions -- larger households enjoy on balance slightly higher levels of basic needs fulfillment.

Whilst the H-S weights make very little difference to the mean value of these indicators, the correction of the 1985 and 1986 data sets is nevertheless important for basic needs analysis. Table 16 disaggregates the indicators by poverty status, showing how they are affected by the H-S weights for the very poor, the mid-poor and the non-poor. Whilst the weights make little difference to the measures for the non-poor, they are seen to have a far more significant effect on the basic needs indicators of the poor, especially the very poor. For example, literacy rates among the very poor are adjusted downward by 12 percent in 1985 and 10 percent in 1986. Similarly, primary school enrollment rates for the very poor are adjusted downward by 10 percent in 1985 and 5.3 percent in 1986.

7/ For basic needs indicators, the disaggregation by region is particularly important given the role played by the supply of basic-needs services (schooling, health clinics, etc), which varies tremendously between regions in Côte d'Ivoire.

8/ For example, literacy rates in other cities in 1986 varied from 44.2 for one or two member households to 48.1 for households of between 10 and 17 members, and to 37.3 for households of size 18 and over. As an example of a rural area, comparable figures for East Forest are 18.9, 28.0 and 28.5 respectively.

Table 15

Côte d'Ivoire - Selected Basic Needs Indicators by Region, 1985-86

	1985								1986							
	Literacy (% able to read)		Net Primary Enrollment Rates (%)		% of House-holds w/ access to tapwater		Percent ill people who consult doctor/nurse		Literacy (% able to read)		Net Primary Enrollment Rates (%)		% of House-holds w/ access to tapwater		Percent ill people who consult doctor/nurse	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Abidjan	54.3	55.0	59.8	63.3	45.3	47.3	63.0	62.5	51.9	53.1	63.6	63.9	49.4	48.5	63.6	63.6
Other Cities	46.3	45.7	60.7	60.6	47.5	46.5	55.3	53.9	44.5	45.5	55.4	55.2	46.3	46.8	56.0	55.8
East Forest	23.6	21.3	45.5	45.0	10.0	8.5	46.7	43.8	25.1	24.2	49.3	48.5	8.8	7.2	49.7	47.2
West Forest	21.3	20.1	43.9	43.2	-	-	41.1	39.6	21.4	30.6	37.6	36.7	-	-	41.9	39.0
Savannah	10.0	9.9	21.1	21.3	1.8	1.8	30.4	30.3	11.3	10.7	21.0	20.6	3.0	2.9	21.6	22.1
Côte d'Ivoire	31.8	30.9	46.4	46.2	22.0	21.8	47.2	45.8	31.8	31.9	46.6	46.3	22.9	22.7	44.8	43.9

A. Without H-S weights.
B. With H-S weights.

Table 16

Côte d'Ivoire: Selected Basic Needs Indicators by Poverty Status, 1985-86

	1985			1986		
	Without H-S weight	With H-S Weight	Difference (%)	Without H-S Weight	With H-S Weight	Difference (%)
Literacy: Percent able to read						
Very Poor	17.1	15.0	-12.3	14.9	13.4	-10.1
Mid-Poor	21.8	19.3	-11.5	23.9	23.1	-3.3
Non-Poor	37.2	36.3	-2.4	36.7	36.2	-1.4
All	31.8	30.9	-2.8	31.8	31.9	+0.0
Net Primary Enrollment Rates (%)						
Very Poor	27.3	24.6	-9.9	24.5	23.2	-5.3
Mid-Poor	39.8	39.4	-1.0	37.8	36.8	-2.6
Non-Poor	51.8	51.9	+0.2	53.2	52.5	-1.3
All	46.4	46.2	-0.4	46.6	46.3	-0.6
Percent of households w/access to tap water						
Very Poor	1.3	1.5	+15.4	2.3	4.4	+91.3
Mid-Poor	9.9	7.9	-20.2	8.6	7.7	-10.5
Non-Poor	29.2	28.7	-1.7	31.2	29.4	-5.8
All	22.0	21.8	-0.9	22.9	22.7	-0.9
Percent of ill people who consult doctor or nurse (%)						
Very Poor	32.8	30.7	-6.4	30.9	29.2	-5.5
Mid-Poor	38.2	36.5	-4.5	32.4	30.3	-6.5
Non-Poor	51.5	49.7	-3.5	51.5	49.7	-2.0
All	47.2	45.8	-3.0	44.8	43.9	-2.0

The adjustments underscore again the need to ensure that any sampling biases are identified and corrected. In the particular case of the CILSS, the corrections for basic needs indicators are only quantitatively important for the poor, but this result must be considered unusual. In most cases, basic needs fulfillment, like welfare in general, is negatively correlated with household size, and thus sampling bias affecting household selection would be expected to give misleading estimates of the indicators also at the national level. At any rate, the magnitude of the corrections noted for the poor in Côte d'Ivoire are sufficiently important to affect the targeting of programs of basic needs provision to the poor, in the sense that the needs of the poor, and especially the very poor, are higher than previously estimated.

VII. Concluding Observations

This paper has demonstrated the necessity of investigating closely the sampling design and properties of household survey data before embarking on empirical research. Regrettably, this does not appear to be a frequent practice among users of household survey data. The case study based on the Côte d'Ivoire Living Standards Survey 1985-88 revealed the occurrence of flawed sampling procedures which had not been corrected by previous users of the data. This has resulted in serious biases in estimates of household size, which in turn have yielded severely biased estimates of household expenditures and poverty measures. Basic needs indicators reported for the country as a whole were less affected, but the bias proved to be more pronounced at the lower end of the distribution.

In this paper an appropriate correction procedure was developed. The procedure consists of applying suitably constructed household size weights to the data. The quantitative adjustments to estimated variables proved to be non-trivial and served to underline the seriousness of problems arising from sampling biases. For example, the head count estimate of poverty in Côte d'Ivoire was over-estimated by 14 percent in 1986. The bias proved to differ widely across regions and socio-economic groups and was frequently in the order of

magnitude of 20-30 percent. Such differences are not merely of academic interest but can affect policy interventions guided by survey results.

The correction of sampling bias also affects the time series analysis of the CILSS data. Original results observed a gradually rising trend in poverty in Côte d'Ivoire between 1985-87. In fact, poverty did not change (or even fell marginally) between 1985 and 1986, followed by a rapid increase in 1987. This clearly affects the assessment of macro-economic policies conducted over the period, especially since in 1987 the Government of Côte d'Ivoire abandoned a previously sustained adjustment program. The overestimation of poverty in 1985 obviously also meant that the total increase in poverty between 1985 and 1988 was underestimated. Taking the head-count ratio as an example, poverty was recorded as increasing from 32.4 percent in 1985 to 45.9 percent in 1988 (an increase of 41.7%). However, the weighted head-count for 1985 is only 30.0 percent, so that poverty in fact increased by 53 percent over the period. The underestimation of the trend in poverty is even clearer for regional estimates. In West Forest, for example, the unweighted data record an increase of 164.6 percent, whilst the weighted data indicate that the increase was 210.7 percent. Without applying the H-S weights, the time series analyses of CILSS data are certain to be subject to errors of this order.

The CILSS data have been widely used to research welfare and poverty issues, especially using the 1985-86 data. To our knowledge, none of this work has applied any corrections for the sampling bias noted in this paper. This casts serious doubts on the robustness of many of the findings reported in the earlier work, particularly since the results in this paper have shown that the order of magnitude of the bias is not trivial and will affect welfare and poverty measures regardless of the poverty index and poverty line chosen. More importantly, the policy recommendations in the earlier work may need to be revised.

As a practical matter, what can users of household survey data do to detect possible sampling problems? Our experience suggests that the first line of defense is a thorough knowledge of the country being researched. This alerted us to the surprisingly large

household size estimates in 1985 and 1986 which were out of line with all other information. Second, if multiple years of data are available, the observation of any "jumps" in a given variable is a clear and easily noted signal. Third, and obviously, a critical review of sampling procedures and any changes therein is essential — even if data has been used before. We recognize that this is difficult in many cases because survey documentation tends to be poor. In our case, we found that direct contact with survey staff was extremely helpful to clarify matters. These difficulties notwithstanding, this paper illustrates that the effort to trace sampling information can be very worthwhile in cases where research aims to be of more than mere methodological interest.

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ANNEX 1

Calculation of Household Size Weights by Region

Size Class	Abidjan Pool I (1)	Abidjan Pool II (2)	Abidjan Household Size Weights (2/1)	Other Urban Pool I (1)	Other Urban Pool II (2)	Other Urban Household Size Weights (2/1)	East Forest Pool I (1)	East Forest Pool II (2)	East Forest Household Size Weights (2/1)	West Forest Pool I (1)	West Forest Pool II (2)	West Forest Household Size Weights (2/1)	Savannah Pool I (1)	Savannah Pool II (2)	Savannah Household Size Weights (2/1)
1	11.4159	11.1144	0.97359	5.4054	11.0291	2.04039	3.8589	6.6106	1.71308	2.5000	5.2995	2.11979	5.4847	8.9728	1.63597
2	7.8969	6.9079	0.87476	5.8559	8.3623	1.42802	4.8512	7.8495	1.61806	6.0714	9.5964	1.58058	5.6122	10.9707	1.95477
3	8.0458	8.5128	1.05804	7.6577	7.8752	1.02841	7.3870	9.6616	1.30792	6.0714	12.7474	2.09957	9.1837	11.1386	1.21287
4	6.5688	11.4035	1.73600	6.9820	10.8507	1.55410	9.4818	10.0407	1.05894	11.0714	14.2448	1.28663	8.6735	11.6513	1.34333
5	10.4073	13.1878	1.26717	6.6441	10.3877	1.56344	8.4895	11.8251	1.39290	9.1071	9.3490	1.02655	11.4796	10.1574	0.88482
6	11.9835	10.2472	0.85511	8.7838	11.9792	1.36378	9.9228	11.9360	1.20289	10.5357	16.0547	1.52383	10.4592	8.0799	0.77252
7	8.3376	10.3270	1.23860	9.5721	6.6069	0.69022	8.4895	7.9512	0.93659	8.3929	8.5026	1.01308	7.3980	6.8600	0.92728
8	6.7984	6.7185	0.98824	8.8964	8.3140	0.93454	8.2690	8.8757	1.07337	8.9286	5.0521	0.56583	6.6327	6.3119	0.95164
9	8.1710	5.6220	0.68805	7.5450	5.5604	0.73696	7.0562	6.2777	0.88967	10.0000	5.5469	0.55469	7.1429	4.5173	0.63243
10	4.8717	5.7815	1.18675	5.1802	3.7471	0.72335	5.2922	4.7245	0.89273	7.3214	3.8021	0.51931	6.3776	4.8621	0.76238
11	2.3523	4.3361	1.84335	4.0541	3.7712	0.93023	4.7409	3.7629	0.79372	5.7143	3.0469	0.53320	4.4643	3.6687	0.82178
12	2.9287	1.0367	0.35398	3.6036	2.3245	0.64504	3.6384	2.2744	0.62512	2.6786	1.4063	0.52500	3.1888	2.1040	0.65980
13	3.0888	1.2560	0.40662	3.6036	2.6331	0.73069	4.4101	2.4871	0.56394	2.3214	2.7995	1.20593	3.4439	1.3260	0.38504
14	2.1440	1.1962	0.55793	2.9279	2.0882	0.71319	2.9768	0.6379	0.21430	1.0714	1.0026	0.93576	2.9337	1.9714	0.67198
15	1.4052	0.4087	0.29085	3.1532	1.2683	0.40224	1.7641	1.4238	0.80713	1.7857	0.6510	0.36458	2.1684	1.9360	0.89284
16	0.3097	1.0965	3.54060	3.0405	0.7475	0.24584	2.6461	1.1372	0.42977	1.4286	0.2995	0.20964	1.0204	1.0873	1.06559
17	1.1361	0.2193	0.19303	0.7883	0.3086	0.39153	2.0948	0.6379	0.30453	1.0714	0.2995	0.27951	1.1480	1.0873	0.94719
≥ 18	2.1383	0.6280	0.29369	6.3063	2.1460	0.34030	4.6307	1.8861	0.40731	3.9286	0.2995	0.07623	3.1888	3.2974	1.03406

See main text for definitions

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